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(19)

(54) GRANULATING UREA

(71) We, FISONS LIMITED, a British Company, of Fison House, 9 Grosvenor Street, London, W1X 0AH, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a process for granulating urea.

Whilst various methods for making particulate urea have been proposed, no satisfactory method has been devised for producing urea particles suitable for inclusion in blended fertilizers. Thus, prilled urea has a small particle size which causes the urea particles to segregate out during blending.

We have now devised a method by which urea particles suitable for use in the production of blended fertilizers may be produced.

Accordingly, the present invention provides a process which comprises preparing a molten urea containing less than 0.5% by weight of water; tumbling or agitating as hereinafter defined a bed of particles consisting essentially of urea particles in a granulation device rotating about an axis which is inclined at less than 20° to the horizontal; spraying molten urea onto the bed and allowing the particles to grow in size by agglomeration to give agglomerated particles.

The invention is principally directed to the granulation of urea alone, although up to 5% by weight of other materials, for example potassium chloride or ammonium phosphate which lower the melting point of the urea, may be present.

The invention is characterised in part by the fact that the urea feed to the granulation device is a molten urea containing less than 0.5% by weight of water. Such melts may be obtained in a number of ways; e.g. by melting solid urea or, more preferably, by evaporating hot concentrated solutions of urea in short residence time evaporators, such as falling or wiped film evaporators. It is preferred that the molten urea contain as little water as is commercially feasible, preferably less than 0.2% by weight. The molten urea is preferably used at a temperature of between 130 and 137°C, e.g. about 133 to 135°C, to minimise biuret formation. Where a melting point depressant, such as potassium chloride, is used lower melt temperatures may be feasible.

Granulation is carried out by spraying the molten urea onto a tumbling bed of undersize urea particles in the granulation device so as to cause agglomeration of the particles. The granulation device rotates about a generally horizontal axis, i.e. an axis which is at an angle of less than 20° to the horizontal. A suitable form of device is a rotating drum granulator. Granulation is carried out without causing the particles to fall as a curtain through the incoming spray of molten urea. That is, the terms agitation or tumbling as used herein exclude those cases where particles fall freely as a curtain within the granulation device. Furthermore, granulation is preferably carried out without the passage of a cooling gas stream through the granulator. The undersize particles consist of urea particles derived from recycled material, although during the initial start up of the granulation particles other than urea particles may be used to provide the initial nuclei from which the granular urea product is formed. Since the urea melt provides the major part of the liquid phase required for granulation, the size of the granulated product can be readily controlled by varying the rate of feed of the melt and the temperature at which granulation is carried out. In order to produce granules in which 95% by weight of the particles have a size in the range 2 to 4 mms, we prefer to carry out the granulation using a weight ratio of urea melt feed to urea particles in the granulator of from 0.75:1 to 2.1:1 and a temperature of from 100 to 125°C in the bed of particles in the granulator.

Apart from the use of the low moisture content molten urea to supply the liquid phase during granulation and the avoidance of free falling particles in the granulator, the granulation process may be carried out in the conventional manner used for granulating other fertilizer materials.

The product from the granulator is usually classified, with off size material being recycled to the granulator, with crushing if

necessary; and is usually cooled with a coolant gas stream such as air. The cooling may be carried out before or after classification. Alternatively the product ex granulator may be partially cooled, then classified to remove fine particles, then cooled further before product and oversize particles are removed. Cooling is preferably carried out in a rotating drum through which air at ambient temperature is blown, preferably counter current to the particles. The product size material may be subjected to other treatments, e.g. coating or dusting, if desired.

The ultra fine material suspended in the off gases from the cooler is separated out, e.g. in a cyclone or bag filter, and the ultra fine material is recycled to an earlier stage in the process, e.g. to the urea melt preparation stage and/or to the granulator. However, in some cases the ultra fine material may not be incorporated into the granules in the granullator and builds up in the plant. This problem is overcome if the ultra fine material is returned to the solution which is to be evaporated to form the urea melt as opposed to the granulator.

The process of the invention produces large granules of urea with surface properties similar to those of granular diammonium phosphate, monoammonium phosphate and compacted KCL. The similarity of surface properties and size of the urea granules renders them compatible with these other components with the result that a blended formulation made therefrom is less likely to segregate during storage. The invention therefore also provides a blended fertilizer composition comprising a mixture of granules containing at least one fertilizer ingredient other than urea with urea granules produced by the process of the invention. The invention further provides a process for producing a blended fertilizer which comprises mixing urea granules produced by the process of the invention with granules comprising at least one other fertilizer compound.

The present invention will now be illustrated by the following Examples in which all parts and percentages are by weight unless stated otherwise.

Example 1

A melt of urea (52.9 parts) containing 0.5 parts of water was prepared by flash evaporating a solution of urea in water. The melt at 138°C was sprayed into a rotating drum granulator containing recycled offsize urea (47.1 parts at 84°C, 100% less than 1.7 mm diameter) and the mixture granulated at 119°C. The product issuing from the granulator consisted of hot urea particles with the following sieve analysis:

Oversize:	>4.0 mms	3.1 parts
Product:	1.7 to 4 mms	54.7 parts
Fines:	<1.7 mms	42.2 parts

The product was screened whilst still hot, the fine material being recycled directly, the oversize and product being cooled to 70°C in a rotary tube cooler through which air was blown. The oversize was crushed to less than 1.7 mm size and returned to the granulator. The off-gases from the cooler were passed to a cyclone dust separator to remove entrained urea particles. The removed particles were fed back to the hot urea solution fed to the flash evaporator.

Example 2

The process of Example 1 was repeated, except that the fine dust from the cooler cyclone was recycled directly to the granulator.

The granules produced by the processes of Examples 1 and 2 were approximately 2½ times as hard as urea prills, and were suitable for use in the production of blended fertilizers.

WHAT WE CLAIM IS:—

1. A process which comprises preparing a molten urea containing less than 0.5% by weight of water; tumbling or agitating as hereinbefore defined a bed of particles consisting essentially of urea particles in a granulation device rotating about an axis which is inclined at less than 20° to the horizontal; spraying molten urea onto the bed; and allowing the particles to grow in size by agglomeration to give agglomerated particles.

2. A process as claimed in claim 1 wherein the agglomerated particles are recovered, cooled in a coolant gas stream and fine solid particles entrained in the coolant gas stream are recovered and recycled to the urea melt preparation stage and/or to the granulation device.

3. A process as claimed in either of claims 1 or 2 wherein up to 5% by weight of other materials are present in the bed of particles of urea.

4. A process according to any of the preceding claims wherein the molten urea contains less than 0.2% by weight of water.

5. A process according to any of the preceding claims wherein the weight ratio of molten urea fed to the granulation device to the weight of urea particles in the bed in the granulation device is from 0.75:1 to 2.1:1; and the temperature of the particles in the bed is from 100 to 125°C.

6. A process according to any of the preceding claims wherein the granulation device is a rotating drum type granulator.

7. A process according to claim 1 substantially as hereinbefore described.

8. A process according to claim 1 substantially as hereinbefore described in the Examples.

9. Granular urea whenever produced by a process as claimed in any of claims 1 to 8.

10. A process for preparing a blended fertilizer which comprises mixing together

granules as claimed in claim 9 and granules comprising at least one other fertilizer compound.

11. A blended fertilizer composition comprising a mixture of granules as claimed in claim 9 together with granules containing at least one other fertilizer compound.

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